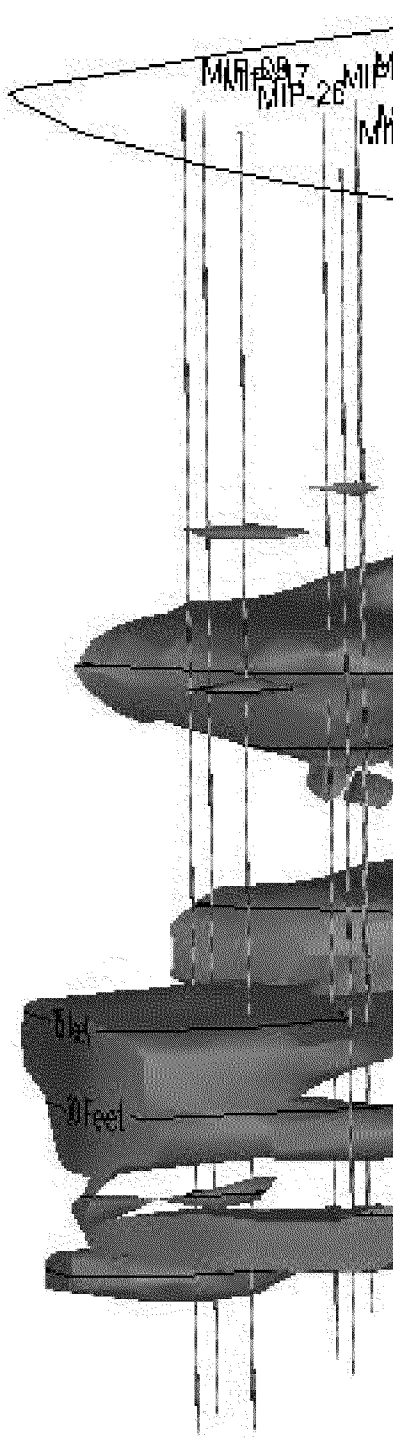
MIP-26
Feet

CASCADE
DRILLING | TECHNICAL SERVICES

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Introduction

Cascade Technical Services has prepared this Data Imaging Report for CTS based on data produced by the advancement of the MIP system at the Former Chemical Facility. This report provides visual renderings of data using the Mining Visualization System (MVS) software; develop by CTech Development Corporation (www.ctech.com).

Renderings of MIP data are provided in the four dimensional models (model files are provided individually as separate attachments). These models are composed of the three spatial dimensions with the additional dimension relating to detector response (commonly referred to as 4DIM models). The models provide an interactive interface that allows the user to produce screen shots from any angle, magnification, or detector response value for each respective model.

The sections below provide a summary of the project, a summary of the data imaging contained in this report, a description of the how the images provided were developed, a description how to navigate 4DIM models, the 4DIM files (separate files), and a description of the limitations regarding the imaging presented with this report.

Project Summary

This section provides a summary of field activities completed by Cascade Technical Services at the Former Chemical Facility the equipment used, the duration of field activities, the configuration of the MIP system and any relevant site information provided by CTS.

On January 19th through February 29th 2016, Cascade Technical Services advanced 104 direct push MIP borings from the ground surface to as deep as 78.15 feet below ground surface (bgs). In order to advance the MIP borings Cascade Technical Services mobilized one MIP system, one MIP specialist and one direct-push drill rig operator to the project site.

For the purposes of this project, the MIP system was equipped with an Electrical Conductivity probe, an Electron Capture Detector (ECD), a Photo Ionization Detector (PID), a Flame Ionization Detector (FID) and a Halogenated Specific Detector (XSD). During the advancement of each boring, the response of each detector, relative to depth, was recorded in accordance with the standard operating procedures for the MIP system.

The details associated with each boring are presented in Table 1 below.

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Table 1 **Summary of MIP Borings**

MIP Boring	Date	Time	Total Depth	Notes
CTS-MIP-1	1.19.2016	12:20	67.75	Refusal at 67.75 feet bgs.
CTS-MIP-2	1.20.2016	09:09	68.95	Refusal at 68.95 feet bgs.
CTS-MIP-3	1.20.2016	11:44	59.80	Refusal at 59.80 feet bgs.
CTS-MIP-4	2.2.2016	15:11	63.20	Refusal at 63.20 feet bgs.
CTS-MIP-8	1.27.2016	10:34	78.15	Refusal at 78.15 feet bgs.
CTS-MIP-9	1.21.2016	9:00	54.90	Refusal at 54.90 feet bgs.
CTS-MIP-10	1.21.2016	12:37	59.95	Refusal at 59.95 feet bgs.
CTS-MIP-11	1.20.2016	14:13	54.80	Refusal at 54.80 feet bgs.
CTS-MIP-12	2.2.2016	11:01	56.55	NONE
CTS-MIP-13	2.3.2016	15:33	60.60	Refusal at 60.60 feet bgs.
CTS-MIP-14	2.1.2016	15:50	45.45	NONE
CTS-MIP-15	1.28.2016	09:54	67.55	Refusal at 67.55 feet bgs.
CTS-MIP-16	2.1.2016	09:11	73.60	Refusal at 72.40 feet bgs.
CTS-MIP-17	1.27.2016	13:25	76.65	Refusal at 76.65 feet bgs.
CTS-MIP-18	1.21.2016	15:11	55.90	Refusal at 55.90 feet bgs.
CTS-MIP-19	1.22.2016	09:18	55.90	Refusal at 55.90 feet bgs.
CTS-MIP-20	1.22.2016	11:52	56.00	Refusal at 56.00 feet bgs.
CTS-MIP-21	2.2.2016	12:44	56.10	Refusal at 56.10 feet bgs.
CTS-MIP-22	2.3.2016	14:01	45.55	NONE
CTS-MIP-23	2.1.2016	14:28	58.00	Refusal at 58.00 feet bgs.
CTS-MIP-24	1.28.2016	12:14	62.65	Refusal at 62.65 feet bgs.

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CTS-MIP-25	1.27.2016	16:20	68.45	Refusal at 68.45 feet bgs.
CTS-MIP-26	1.29.2016	13:41	76.55	Refusal at 76.55 feet bgs.
CTS-MIP-27	1.20.2016	16:07	50.75	Refusal at 50.75 feet bgs.
CTS-MIP-28	1.22.2016	14:30	52.55	Refusal at 52.55 feet bgs.
CTS-MIP-29	2.3.2016	08:37	48.60	Refusal at 48.60 feet bgs.
CTS-MIP-30	2.3.2016	10:05	49.50	Refusal at 49.50 feet bgs.
CTS-MIP-31	2.3.2016	11:41	49.30	Refusal at 49.30 feet bgs.
CTS-MIP-32	2.1.2016	11:21	45.00	NONE
CTS-MIP-33	1.28.2016	14:20	60.10	Refusal at 60.10 feet bgs.
CTS-MIP-34	1.29.2016	09:07	69.20	Refusal at 69.20 feet bgs.
CTS-MIP-35	1.29.2016	11:16	71.15	Refusal at 71.15 feet bgs.
CTS-MIP-36	2.15.2016	12:29	44.25	Refusal at 44.25 feet bgs.
CTS-MIP-37	2.15.2016	14:14	42.15	Refusal at 42.15 feet bgs.
CTS-MIP-38	2.4.2016	11:09	41.50	Refusal at 41.50 feet bgs.
CTS-MIP-39	2.4.2016	12:49	44.50	Refusal at 44.50 feet bgs
CTS-MIP-40	2.4.2016	14:50	46.40	Refusal at 46.40 feet bgs.
CTS-MIP-41	2.4.2016	16:15	42.55	Refusal at 42.55 feet bgs.
CTS-MIP-42	2.8.2016	09:00	40.55	Refusal at 40.55 feet bgs.
CTS-MIP-43	2.5.2016	09:11	45.65	Refusal at 45.65 feet bgs.
CTS-MIP-44	2.8.2016	09:00	40.55	Refusal at 40.55 feet bgs.
CTS-MIP-45	2.11.2016	16:03	34.95	Refusal at 34.95 feet bgs.
CTS-MIP-46	2.12.2016	11:09	41.00	Refusal at 41.00 feet bgs.
CTS-MIP-47	2.19.2016	08:28	35.35	Refusal at 35.35 feet bgs.
CTS-MIP-48	2.19.2016	13:13	29.70	NONE

CTS-MIP-49	2.19.2016	14:13	29.95	NONE
CTS-MIP-50	2.12.2016	14:00	45.95	Refusal at 45.95 feet bgs.
CTS-MIP-51	2.19.2016	09:41	32.85	NONE
CTS-MIP-52	2.19.2016	10:49	32.55	NONE
CTS-MIP-53	2.22.2016	08:20	30.85	NONE
CTS-MIP-54	2.22.2016	09:37	31.80	NONE
CTS-MIP-55	2.17.2016	09:10	37.70	Refusal at 37.70 feet bgs.
CTS-MIP-56	2.17.2016	11:05	27.35	NONE
CTS-MIP-57	2.17.2016	12:56	26.30	NONE
CTS-MIP-58	2.18.2016	11:33	28.70	NONE
CTS-MIP-59	2.18.2016	15:31	30.35	NONE
CTS-MIP-60	2.22.2016	12:05	35.40	NONE
CTS-MIP-61	2.22.2016	16:21	35.05	NONE
CTS-MIP-62	2.23.2016	14:59	30.65	NONE
CTS-MIP-63	2.17.2016	10:16	26.95	Refusal at 26.95 feet bgs.
CTS-MIP-64	2.17.2016	15:12	21.75	NONE
CTS-MIP-65	2.18.2016	08:28	24.70	NONE
CTS-MIP-66	2.18.2016	10:34	25.90	NONE
CTS-MIP-67	2.18.2016	13:30	25.75	NONE
CTS-MIP-68	2.22.2016	10:57	28.75	NONE
CTS-MIP-69	2.22.2016	14:01	35.75	NONE
CTS-MIP-70	2.23.2016	10:12	35.10	NONE
CTS-MIP-71	2.23.2016	11:15	33.85	NONE
CTS-MIP-72	2.23.2016	13:16	28.85	NONE

CTS-MIP-73	2.23.2016	13:58	16.65	NONE
CTS-MIP-75	2.10.2016	09:16	45.30	Refusal at 45.30 feet bgs.
CTS-MIP-76	2.5.2016	11:05	45.25	Refusal at 45.25 feet bgs.
CTS-MIP-77	2.10.2016	10:59	40.05	Refusal at 40.05 feet bgs.
CTS-MIP-78	2.10.2016	14:10	40.90	Refusal at 40.90 feet bgs.
CTS-MIP-79	2.10.2016	15:47	40.90	Refusal at 40.90 feet bgs.
CTS-MIP-80	2.11.2016	09:40	41.00	Refusal at 41.00 feet bgs.
CTS-MIP-81	2.11.2016	11:23	40.00	Refusal at 40.00 feet bgs.
CTS-MIP-82	2.11.2016	13:44	37.95	Refusal at 37.95 feet bgs.
CTS-MIP-83	2.17.2016	13:41	17.70	NONE
CTS-MIP-84	2.17.2016	14:33	20.75	NONE
CTS-MIP-85	2.17.2016	15:59	21.85	NONE
CTS-MIP-86	2.18.2016	09:30	21.80	NONE
CTS-MIP-87	2.18.2016	14:24	25.80	NONE
CTS-MIP-89	2.23.2016	16:16	33.70	Refusal at 33.70 feet bgs.
CTS-MIP-90	2.25.2016	08:16	33.50	Refusal at 33.50 feet bgs.
CTS-MIP-91	2.24.2016	11:56	36.80	Refusal at 36.80 feet bgs.
CTS-MIP-92	2.24.2016	13:48	31.85	Refusal at 31.85 feet bgs.
CTS-MIP-93	2.24.2016	08:25	33.90	Refusal at 33.90 feet bgs.
CTS-MIP-94	2.24.2016	09:24	30.45	Refusal ag 30.45 feet bgs.
CTS-MIP-95	2.24.2016	10:47	37.80	Refusal at 37.85 feet bgs.
CTS-MIP-96	2.25.2016	09:24	38.45	Refusal at 38.45 feet bgs.
CTS-MIP-97	2.25.2016	10:31	35.85	Refusal at 35.85 feet bgs.
CTS-MIP-98	2.26.2016	09:57	23.75	NONE

CTS-MIP-99	2.26.2016	12:00	57.15	NONE
CTS-MIP-100	2.25.2016	11:40	36.15	NONE
CTS-MIP-101	2.25.2016	13:33	43.50	NONE
CTS-MIP-102	2.25.2016	14:40	43.85	NONE
CTS-MIP-104	2.26.2016	14:04	54.50	NONE
CTS-MIP-106	2.25.2016	15:49	41.80	NONE

Summary of Data Visualization

Data Visualization is graphical display of Electrical Conductivity information, which provides an interpolation of their data set. This output, which is provided in 4DIM files, provides the user a powerful tool of a skilled visualization options. This option gives a visual interpolation of the detector or analytical results. This allows the end user to see how the data come together and to visualize potential movement of the contaminant. At the same time it provides a way for the environmental firm to display potential remediation approaches to the end user in simplistic format.

Model Development

This section describes the types of images provided in this report and the methods used to develop them. As noted above, Cascade Technical Services utilized CTech's MVS software to develop the data renderings that are listed in this report. The settings and parameters associated with these renderings are based on the suggested configuration by CTech. Cascade Technical Services used MVS software to develop a base model and three types of data imaging including:

- Three dimensional models;
- Vertical cross-sections; and
- Horizontal cross-sections;

Each of these model types may be produced using the various data types. For example, three dimensional models may be produced using MIP response, as well as using EC to give a three dimensional indication of site lithology. Below is a discussion regarding the settings and parameters associated with each type of data images previously noted.

Prior to Kriging MIP data, a domain is created as a hierarchy to the MIP data, which is comprised of all the sample locations. This is called the convex hull which can be visualized as the shape assumed by a rubber band that has been stretched around the set and released to conform as closely as possible to it. MIP data is then Kriged, which is a mathematical process recognized by the EPA as the standard means for interpolation and extrapolation of measured data.

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4DIM Models Provided

Cascade Technical Services has provided 4DIM models which allow the user to manipulate each model spatially and determine the detector response value. The user of these models may select various angles, magnifications, and detector response values to develop their own static figures of these models. The following 4DIM models are listed in this report in Table 2 (please note that these are standalone files and only viewable on a computer).

Three Dimensional Models

Three Dimensional Models represent a collection of points in 3D space. The models will display the interpolation of the data used within this project at various concentrations and/or responses. They give the viewer an indication of the extent of distribution based on the data set used. However the interpolation has limitations based on the gridding pattern and depth of the borings. To provide a competent interpolation the borings X, Y need to be within a grid pattern.

Vertical Cross-Sections

Vertical Cross-Sections are comprised of connecting borings and providing a vertical profile of the model providing all detector information from surface to total depth. These are viewed from easting or northing of the model and provide side profile of the detector responses.

Horizontal Cross-Sections

Horizontal Cross-Sections are horizontal profiles of the base model at a given depth providing all detector information at a given depth in Mean Sea Level (MSL). These are viewed from a plan view and provide the detector response at each depth.

Histogram

Histogram is a geographical representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable.

Model Development Notes

CTS provided boring coordinates in State Plane. For all of the ECD models the detector max was set at 1.4E+007uV.

Access to 4DIM Models

4DIM Link: https://od.lk/d/MF8xMDk5NjkzOTFf/4Dim%20-%20cts%20-%20former%20chemical%20facility%20-%20pride%20towm%2C%20usa%20-%203-2-2016.zip

To view 4DIM files, the user is required to have the 4DIM Player installed on his/her computer. The 4DIM Player may be downloaded at http://www.ctech.com/?page=&action=download&fid=129 or accessed via the CTech website www.ctech.com.

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Table 2 **List of 4DIM files provided to CTS.**

Name of file	Date issued
EC - 3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
EC - TV -3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
EC - EASTING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
EC - HORIZONTAL SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
EC - NORTHING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
ECD - 3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
ECD - TV -3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
ECD - EASTING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
ECD - HORIZONTAL SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
ECD - NORTHING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
FID - 3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
FID - TV -3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
FID - EASTING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
FID - NORTHING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
FID - HORIZONTAL SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
PID - 3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
PID - TV -3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
PID - EASTING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
PID - NORTHING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
PID - HORIZONTAL SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
XSD - 3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
XSD - TV -3D - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA NY - 3-2-2016.4D	3/2/2016
XSD - EASTING SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016
XSD - HORIZONTAL SLICE - CTS - FORMER CHEMICAL FACILITY – PRIDE TOWN, USA - 3-2-2016.4D	3/2/2016

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Limitations

The information and images presented in this report rely on data produced by Cascade Technical Services under the supervision of CTS and/or data provided by CTS. Because Cascade Technical Service's report is based on information, the accuracy of which has not been determined, Cascade Technical Services cannot and does not guarantee that the information and images provided in this report are exact representations of potential conditions at the Site. The graphics provided within this report have been prepared using CTech's industry accepted Mining Visualization System software. Unless requested by CTS. The models presented herein were developed using the recommended settings and values provided by CTech. Unless stated otherwise herein, this report is intended for the sole use of CTS. Cascade Technical Services assumes no responsibility for decisions or actions based on the information and images contained in this report.

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Histogram: What is it and why we use it.

The histogram is a fundamental object for summarizing the frequency distribution of an attribute or combination of attributes. A histogram summarizes a dataset by grouping the data values into subsets, or "buckets" and then, for each bucket, computing a small set of summary statistics that can be used to approximately reconstruct the data in the bucket. Histograms are commonly used in statistics to demonstrate how many of a certain type of variable occurs within a specific range.
A histogram is a graphical method of presenting a large amount of data by way of bars, to reflect the distribution frequency and proportion or density of each class interval as a data set. Since a histogram provides planners and analysts with information presented in a compact and organized manner, it allows one to perform the following:

*Analyze a large data set without having to delve in to word descriptions for purposes of distinguishing each variable and their frequencies in a given set of intervals.
*Facilitate the comparison of process results with specification limits.
*Instantly communicate information about variables; their values and their occurrences quickly and easily to other.
*Make informed decisions based on data analysis.

Line graph: What is it and why we use it

A line graph is a device that displays quantitative information or illustrates relationships between two changing quantities (variables) with a line or curve that connects a series of successive data points.

The graph depicts a site wide statistical average of all the borings based on the overall responses of each analyte. It allows you a better understanding of where the highest and lowest concentrations occur. The Histogram breaks down the data into statistical averages whereas the line graph shows the same data based on boring location.

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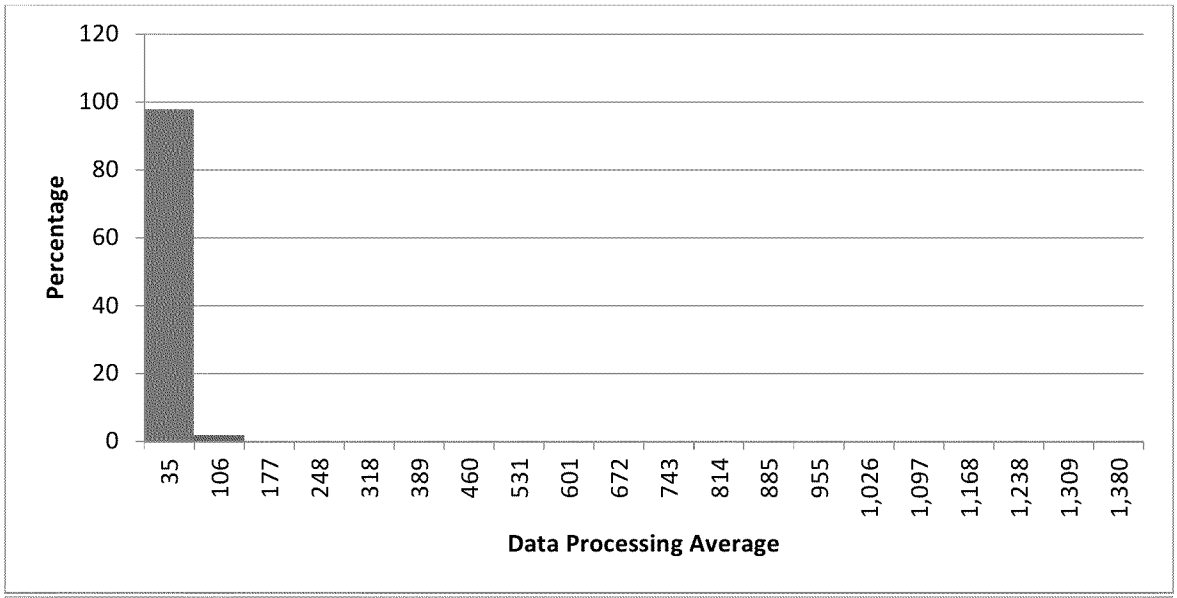
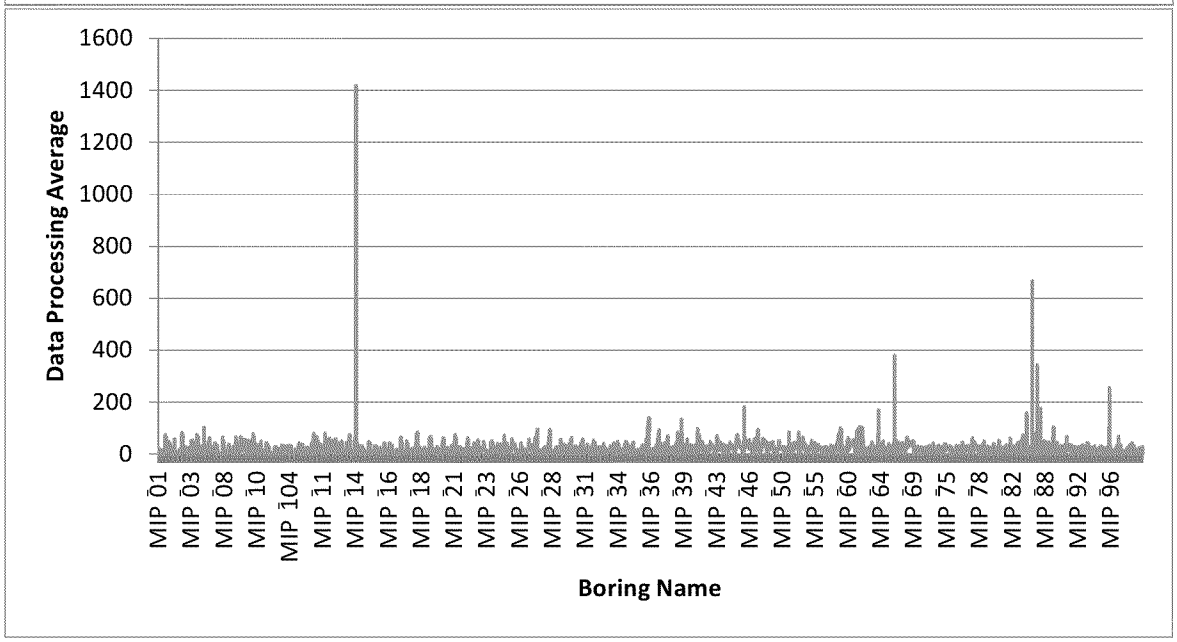
ELECTRICAL CONDUCTIVITY Histogram

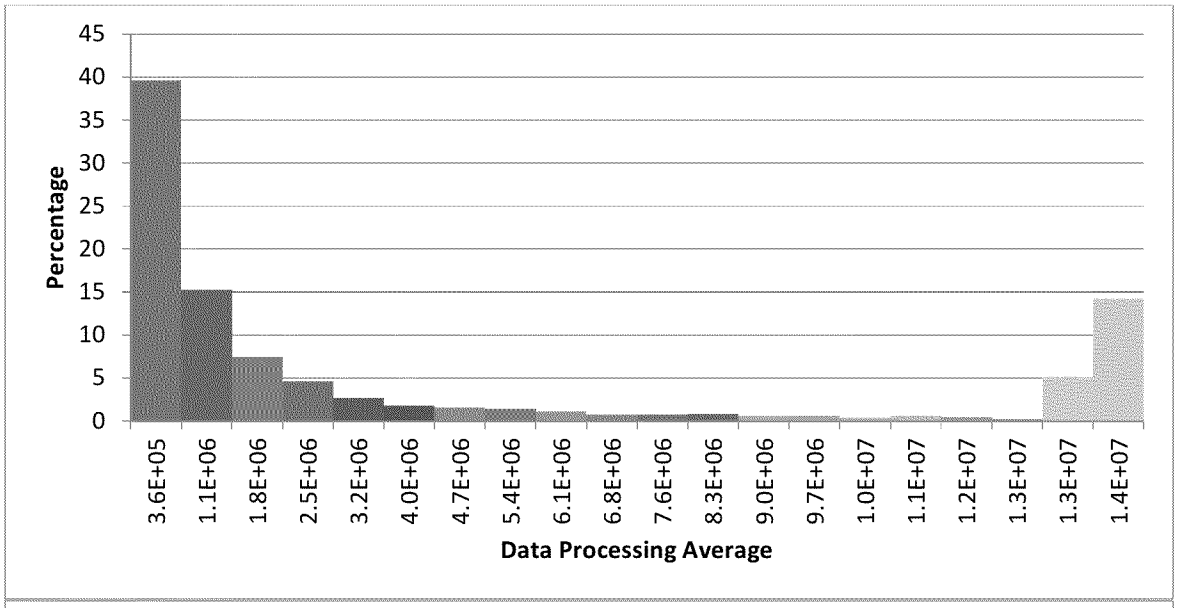


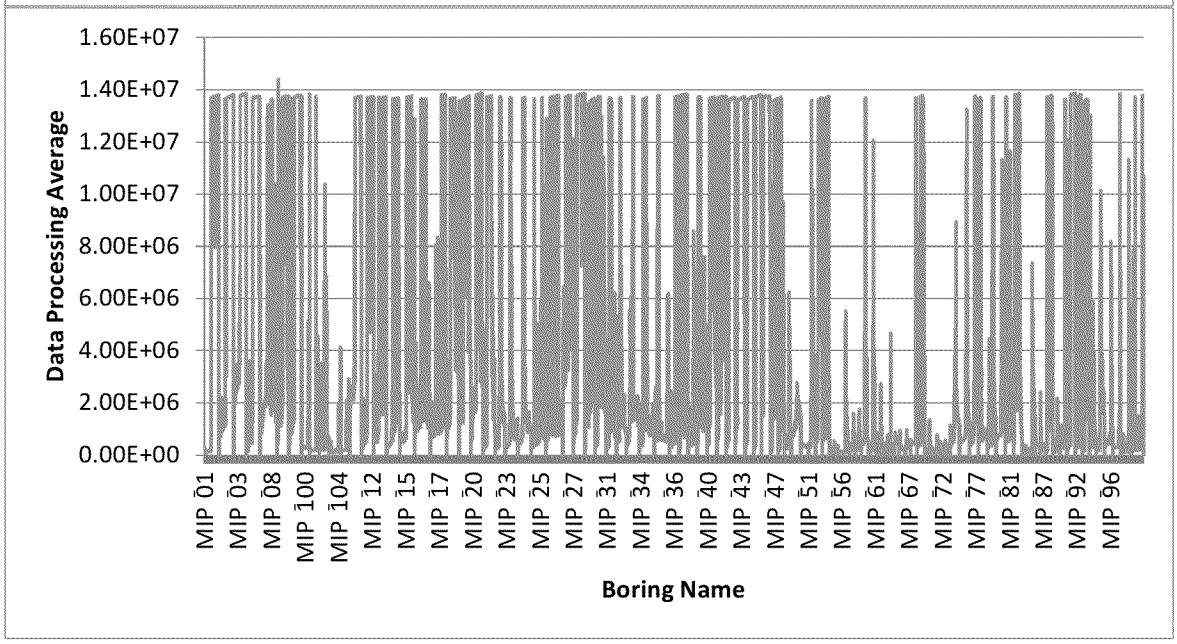


Data Processing Minimum Value: 0

Data Processing Maximum Value: 1415.23

ECD Histogram





Data Processing Minimum Value: 2441

Data Processing Maximum Value: 14400000

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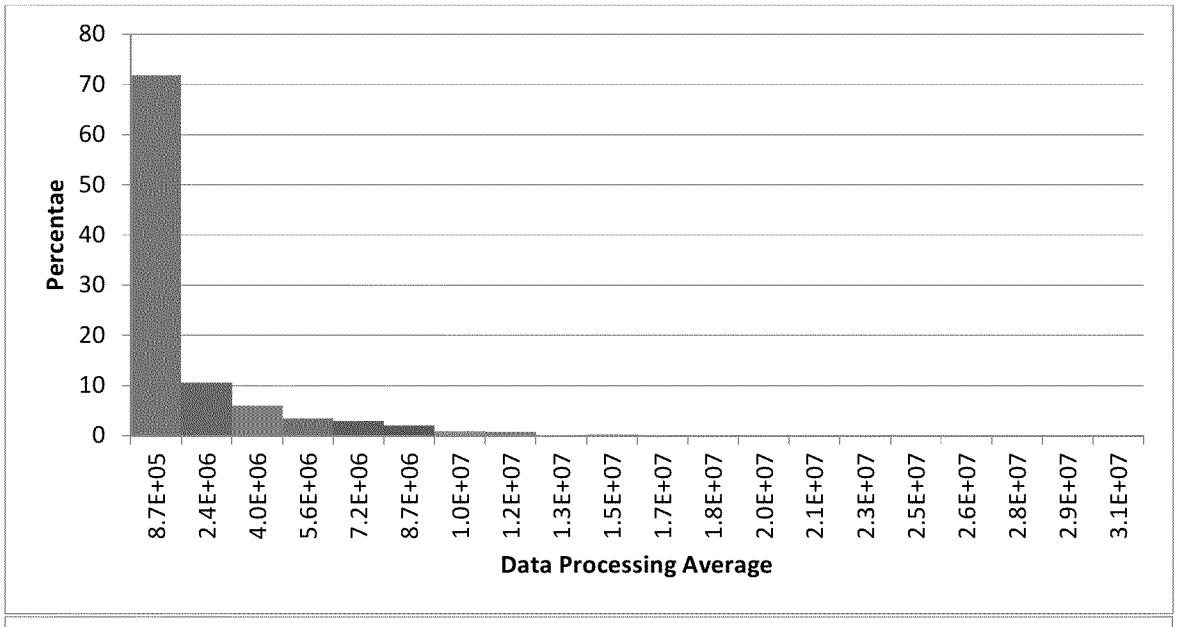
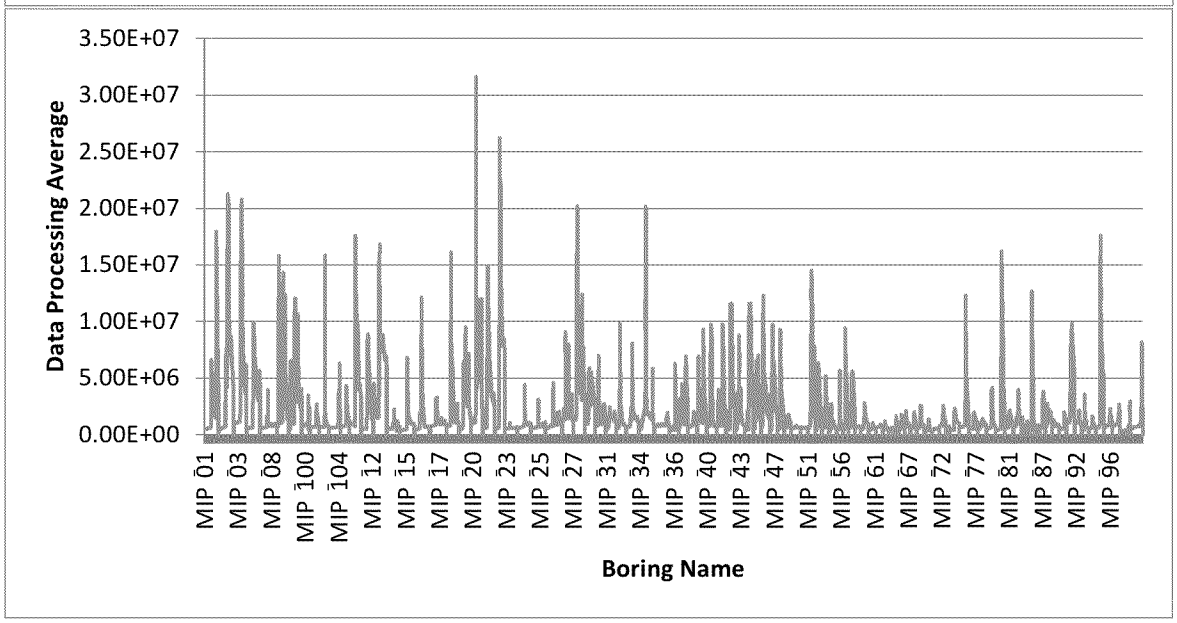
PID Histogram





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Data Processing Maximum Value: 31590318

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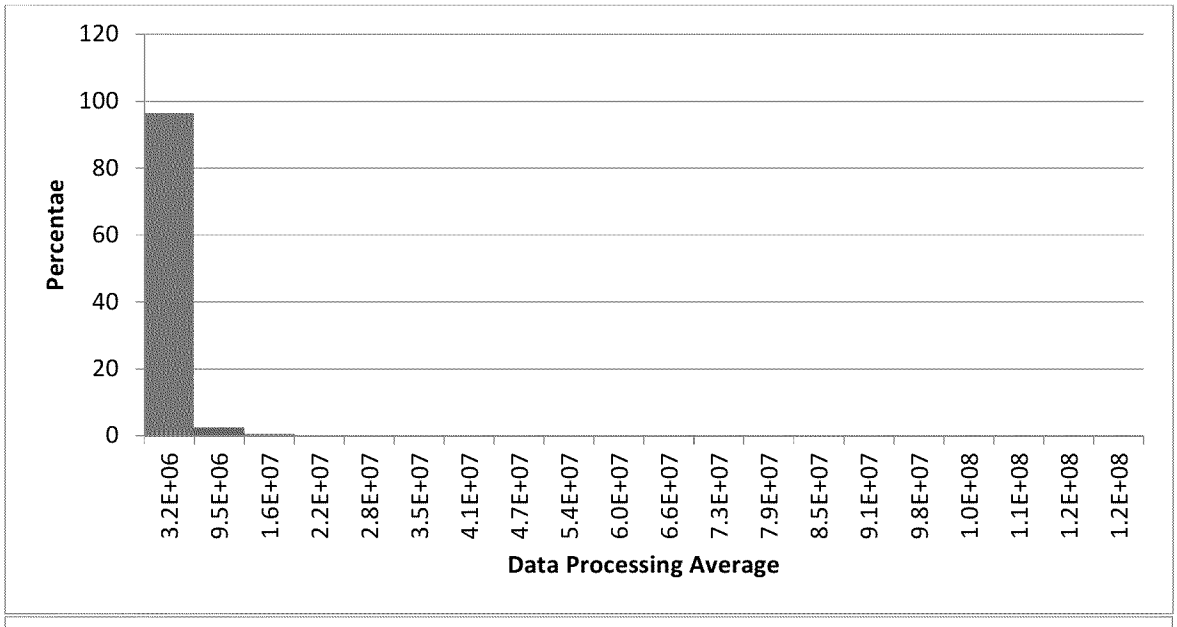
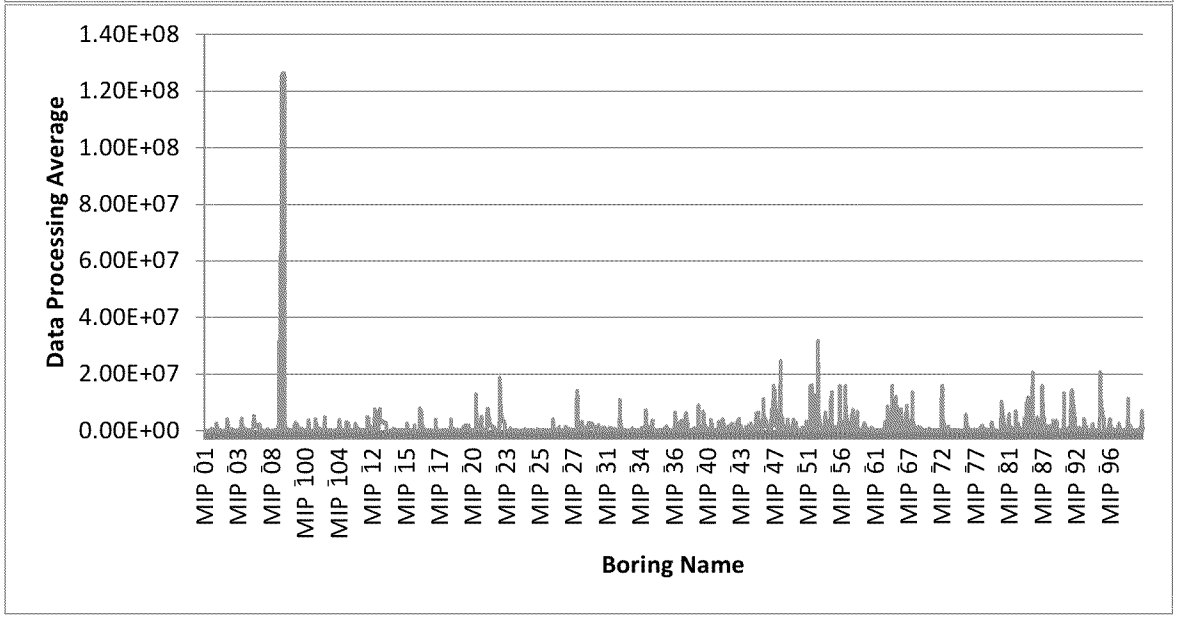
FID Histogram





Data Processing Minimum Value: 305

Data Processing Maximum Value: 126195256

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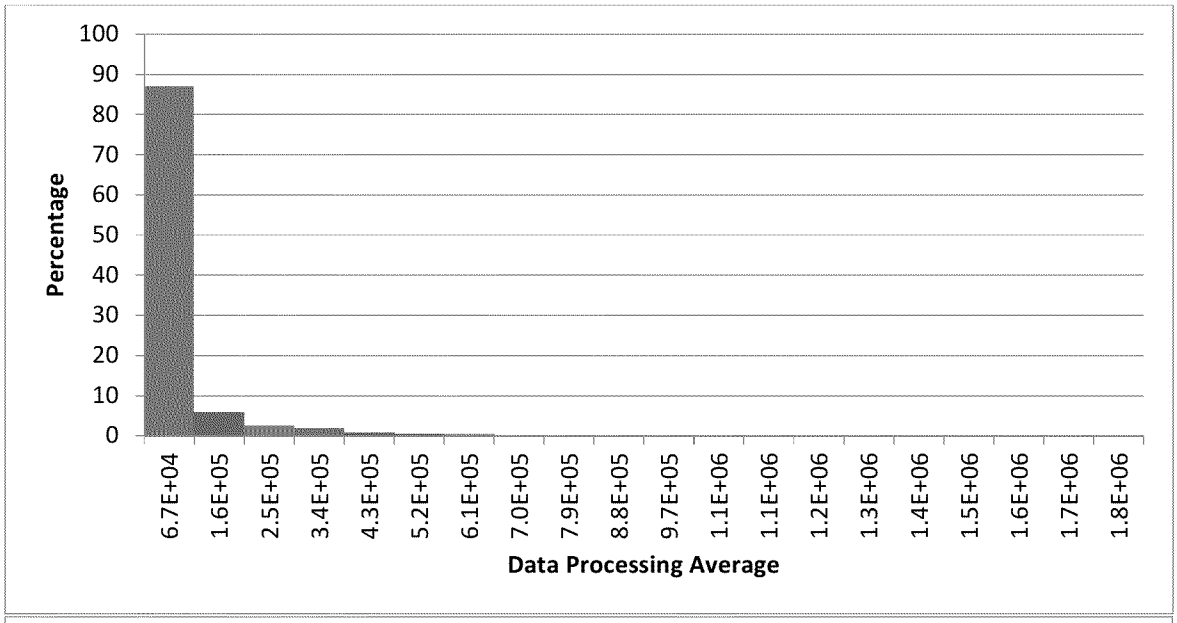
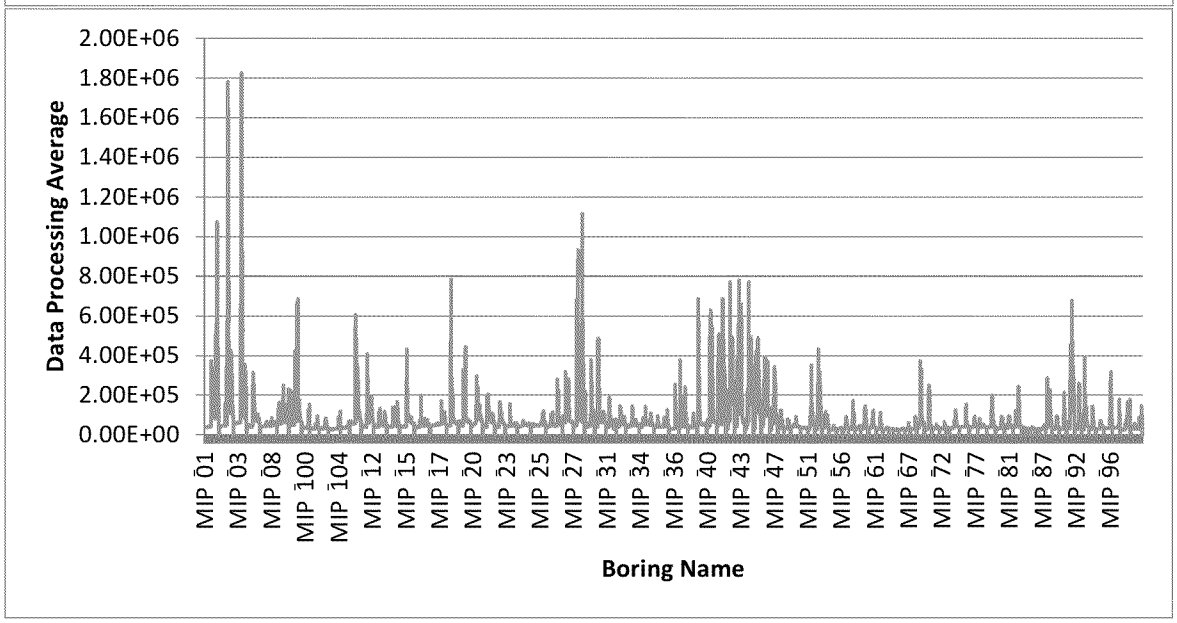
XSD Histogram





Data Processing Minimum Value: 21821

Data Processing Maximum Value: 1825007

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